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Natural Resources Conservation Service

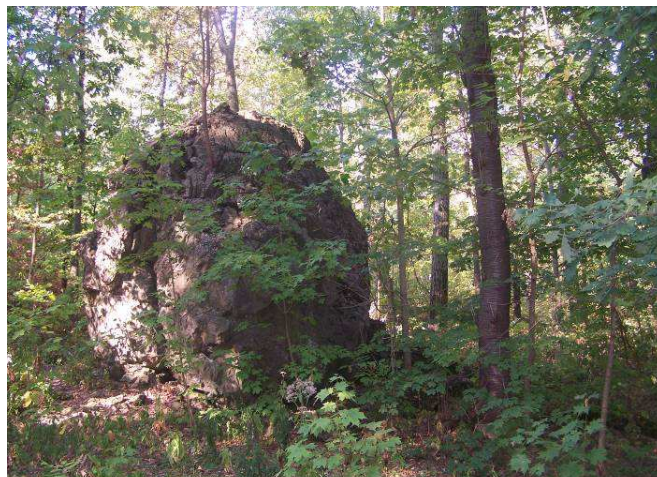


NJ Biology Technical Note: Forest Stand Improvement for Wildlife

Introduction

New Jersey's forest ecosystems offer many economic, recreational, and ecological benefits, including timber resources, aesthetic value, improved air and water quality, and habitat for many plant and animal species. Almost 2 million acres in New Jersey, or about 42 percent of the state, are forested. Many of the larger contiguous forests in this state are also among the largest forested tracts in the entire Mid-Atlantic region, making them a significant regional resource.

Prior to European settlement, New Jersey was made up of more than 4.7 million acres of forested land. Natural disturbances, such as wind storms, ice storms, wildfires, and beaver flooding, maintained a mosaic of successional plant communities across the landscape, providing diverse habitat for a wide range of species. Human disturbances, such as forest clearings for agriculture and timber harvesting, also helped create early successional habitats throughout the landscape. This mosaic of ecological stages was maintained into the twentieth century even as the overall percentage of forestland decreased significantly. Today, roughly 85 percent of the remaining forests are considered uniformly middle-aged, mainly due to wildfire suppression, floodwater manipulation, and decreases in



Healthy forests offer valuable resources to a variety of common and imperiled wildlife species (John Parke, NJA)

agriculture and forestry production. This decrease in disturbance has ultimately led to limited biodiversity. Wildlife habitat is further compromised when it is subjected to additional emerging stressors, such as non-native and invasive species, excessive deer herbivory, forest fragmentation, and climate change. Fortunately, the negative impacts of some of these trends can be reversed with a more proactive approach to enhancing wildlife habitat. Forest Stand Improvement (FSI) with a wildlife focus can be an excellent tool that can enhance the health of a forest ecosystem while improving habitat for wildlife.

Why Manage Forest Habitat for Wildlife?

Almost two thirds of New Jersey's forested land is privately owned, so maintaining diverse wildlife populations across the state will largely depend on private landowners interested in forest management and wildlife habitat. A comprehensive Forest Stewardship Plan (FSP) affords an opportunity for landowners to integrate wildlife habitat enhancements into the overall management of the property.

Wildlife habitat management has long been used to benefit game species, such as American woodcock (*Scolopax minor*), bobwhite quail (*Colinus virginianus*), wild turkey (*Meleagris gallopavo*), waterfowl, and white-tailed deer (*Odocoileus virginianus*). However,



Structural complexity can help increase forest health and improve habitat for wildlife (Kristen Meistrell, NJA)

using similar tactics to enhance conditions for non-game species is gaining popularity, especially with resource managers. This approach is also used in efforts to reverse population declines among a number of rare species and is particularly appealing when the habitat management benefits an entire suite of species. In many cases, traditional habitat management practices for game species require only slight changes in order to increase the suitability for particular non-game species. As of 2013, there are more than 40 endangered or threatened species in New Jersey that utilize forests, including all three of the listed terrestrial mammals: the bobcat (*Lynx rufus*), Indiana bat (*Myotis sodalis*), and Allegheny woodrat (*Neotoma magister*). Other examples of rare species that use forests include the bald eagle (*Haliaeetus leucocephalus*), red-shouldered hawk (*Buteo lineatus*), red-headed woodpecker (*Melanerpes erythrocephalus*), timber rattlesnake (*Crotalus horridus*), wood turtle (*Glyptemys insculpta*), blue-spotted salamander (*Ambystoma laterale*), Cope's gray treefrog (*Hyla chrysocelis*), and the stream-dwelling dwarf wedgemussel (*Alasmidonta heterodon*).

Management Options

A landowner interested in improving forest health while creating habitat for wildlife has a number of FSI options, depending on the existing conditions and the desired

future outcome. Typical FSI techniques include:

- Selective cutting and felling of competitive vegetation
- Girdling select trees
- Herbicide application
- Prescribed burns

These techniques can increase residual tree vigor by reducing competition for resources while enhancing the overall forest health by improving structural complexity. Favoring native species and those that are best suited to site conditions can also reinforce a forest's resiliency to environmental stress.

Vegetation management decisions should consider how habitat changes fit into the landscape of the surrounding properties. Forest species often have large home ranges that extend beyond property boundaries. These species might also have certain life history requirements that include different ecological communities, which may be underrepresented in the region. It is also important to conduct site visits prior to forestry operations in order to evaluate what wildlife currently occupy the property, especially endangered and threatened species. The New Jersey Endangered and Nongame Species Program (ENSP) or the U.S. Fish and Wildlife Service (USFWS) can offer guidance when dealing with these species.



Species that rely on forested uplands and wetlands include: (from top left to top right) the bald eagle (©David Herr, US Forest Service), bobcat (©Gary Kramer, USFWS), dwarf wedgemussel (©Susi Von Oettingen, USFWS), (from center to center right) wood turtle (Kristen Meistrell, NJA), American black bear (©Steve Hillebrand, USFWS), (from bottom left to bottom right) bobwhite quail (NJA Archive), prothonotary warbler (©Kevin Karlson), and eastern kingsnake (Kristen Meistrell, NJA).



Invasive and non-native plants, such as garlic mustard (left) (Suzanne Treyger, NJA), typically lead to limited structural complexity. Promoting vertical and horizontal growth (middle) (Don Donnelly, NJA) can help improve habitat for a variety of species, including wood thrush (right) (©Steve Maslowski, USFWS).

Specific Management Techniques for Improving Wildlife Habitat

There are four main resources that are necessary for the survival of all wildlife species:

- Source of food and nutrients
- Source of clean water
- Source of cover, shelter, and nesting sites
- Space large enough to satisfy life history and home range requirements

Good quality habitat incorporates a matrix of all four of these resources. Some general techniques that can enhance and build the quality of these resources are provided below.

1. Improve Vegetative Structure

FSI can be used to increase solar exposure into the lower forest canopy layers, improving both vertical and horizontal vegetative structure that provides critical food and cover for wildlife. For example, the hooded warbler (*Setophaga citrine*) requires a healthy shrub layer for nesting, while the eastern box turtle (*Terrapene c. carolina*) requires a dense herbaceous layer for food and cover. The creation of small forest openings or standing dead snags, or decreasing the amount of non-native invasive species, are all actions that add to structural complexity.

2. Protect Wetland and Riparian Buffers

Wetland and riparian buffers are crucial for maintaining ecological integrity and water quality. Vegetated buffers around a wetland help slow stormwater runoff, absorb excess nutrients, stabilize the soil and prevent erosion. This maintains high water quality and the ability of the soil to continue supporting a variety of microorganisms and vegetation. When conducting management activities in wetland or riparian areas, it is important to protect vegetation that stabilizes the stream bank and shades the water. Other considerations include limiting the use of heavy machinery in wetland areas, and using wetland-approved herbicides. The New Jersey Forest Service's *NJ Forest and Wetlands Best Management Practices Manual* is a good reference tool for proper procedures and precautions when working in wetland and riparian habitats.

3. Control Invasive and Non-native Species

Invasive plants and insects can degrade habitat quality by outcompeting, stressing, or killing native vegetation. This often results in decreased biodiversity and reduced food and cover value for wildlife species. Non-native invasive plants can often be controlled mechanically and with herbicide applications. For invasive insect outbreaks, the best method of control is prevention, which can be



(From left to right) Vegetative buffers along riparian and wetland habitats (John Parke, NJA) are crucial for maintaining ecological integrity while improving water quality and reducing soil erosion. These vegetative buffers can also help improve habitat for a variety of common and rare wildlife, including the wood duck (©David Herr, US Forest Service), painted skimmer (©Mike Bisignano), and long-tailed salamander (Kristen Meistrell, NJA).



(From left to right) Maintaining a *soft* edge (Kristen Meistrell, NJA) between forests and open areas can help protect a variety of wildlife species. On the other hand, *hard* edge habitat (Kristen Meistrell, NJA) typically attracts large concentrations of white-tailed deer (leading to over-browse) (John Parke, NJA) and brown-headed cowbirds (leading to increased brood parasitism) (©David Herr, US Forest Service).

accomplished by increasing tree vigor and resiliency to infestation. Once outbreaks occur, insect pests such as the emerald ash borer (*Agrilus planipennis*), gypsy moth (*Lymantria dispar*), and hemlock wooly adelgid (*Adelges tsugae*) may require large-scale pesticide applications for control. Typically, these measures have limited practical application in forest settings, so prevention is critical.

4. *Decrease “Hard” Edge Habitat*

When a forested habitat borders a grassland, right-of-way, mowed lawn, or agricultural field, the abrupt transition between the two land cover types is called a *hard* edge. This type of transition area often has adverse effects on local biodiversity. Hard edges have been found to attract brood parasites, such as the brown-headed cowbird (*Molothrus ater*), and certain mammal species that can cause high predation pressure on desirable wildlife. An abrupt transition between forest and open areas often attracts white-tailed deer (*O. virginianus*), leading to over-browsing and a decrease in understory plant diversity. When managing a forest that is adjacent to a field, it may be beneficial to create a wider and more gradual *soft* transition between the two. Planting a variety of native shrubs and maintaining the transition area as a scrub-shrub ecosystem can enhance wildlife habitat and

increase biodiversity.

5. *Promote Mast-Producing Plants*

Mast-producing plants are those that grow an edible fruit or nut that is used as food for wildlife. Soft mast species are those that produce berries and fruits, such as wild strawberries (*Fragaria virginiana*), lowbush blueberries (*Vaccinium angustifolium*), and flowering dogwood (*Cornus florida*). Hard mast species, such as oaks (*Quercus spp*), hickories (*Carya spp*), and walnuts (*Juglans spp*), produce nuts and acorns. Maintaining a balance of soft and hard mast plants that produce food during different times of the year can help maximize the nutritional benefits for a wide variety of insects, birds, mammals, and reptiles.

6. *Retain or Create Snags*

Snags, or standing dead trees, are important structural components of wildlife habitats because they can provide both forage and cover. Dead trees typically harbor large insect populations that are preyed upon by woodpeckers and other birds. As they search for insects, the excavated holes often develop into cavities that are then used by wildlife for shelter and nesting. Larger snags with cavities provide nesting habitat for red-headed woodpecker (*M. erythrocephalus*), barred owl (*Strix varia*), and wood duck (*Aix sponsa*). North American



(From left to right) Mast-producing plants, such as winterberry holly (John Parke, NJA) and willow oak (©Franklin Bonner, US Forest Service), provide forage for a variety of wildlife, including the eastern chipmunk (©David Herr, US Forest Service) and red-headed woodpecker (©Michael Hogan).



(From left to right) Standing dead snags (Kristen Meistrell, NJA) can be created by girdling select trees (Jean Lynch, NJA). This structural element can provide cover and forage for many wildlife species, including the Indiana bat (©Adam Mann, USFWS), northern gray treefrog (Kristen Meistrell, NJA) and American porcupine (John Parke, NJA).

porcupine (*Erethizon dorsatum*) and the American black bear (*Ursus americanus*) will also use large cavities for shelter. Snags offer vital roosting sites for many animals, including the Indiana bat (*M. sodalis*) and the Cope's gray treefrog (*H. chrysocelis*). Girdling select trees during forestry operations is the best way to create standing snags.

7. Create Brush Piles, Exposed Mineral Soils, and Leave Woody Debris on the Ground

Brush piles and downed logs or trees provide cover and forage for a variety of wildlife species. Animals such as the blue-spotted salamander (*A. laterale*), eastern chipmunk (*Tamias striatus*), and the

woodland jumping mouse (*Napaeozapus insignis*) will often forage or take cover near or under downed logs in a forest habitat. Many songbirds, like the wood thrush (*Hylocichla mustelina*), as well as some mammal species, will use brush piles for cover, perches, and forage. In addition, scattered bare soil patches can provide dusting sites (used for dry bathing) for wild turkey (*M. gallopavo*) as well as nest sites for various reptile species. During FSI operations, leave some downed trees that are undesirable for wood products on the forest floor. Create patches of disturbance to expose mineral soils and use downed branches and logs to create brush piles for wildlife.



Downed woody debris provides both cover and forage for wildlife (Kristen Meistrell, NJA)

In addition to the above FSI techniques, several other habitat-enhancing elements can be incorporated into an FSP. The creation of vernal pools can provide excellent habitat for many wildlife species, including breeding habitat for amphibians, such as the spotted salamander (*Ambystoma maculatum*) and wood frog (*Lithobates sylvaticus*). Nest boxes and artificial roosts can also be installed to provide resources for cavity-nesting birds and tree-roosting bats, including the federally endangered Indiana bat (*M. sodalis*). These additional wildlife habitat improvements often require specific conditions, so it is important to consult a natural resource professional with appropriate expertise.



(From left to right) Patches of exposed mineral soil (Kristen Meistrell, NJA) provide many resources to wildlife, including dusting sites for wild turkey (©Dean Elsen, US Forest Service). Vernal pools (John Parke, NJA) also provide resources to a variety wildlife species, including the wood frog (Kristen Meistrell, NJA).



(From left to right) The barred owl (John Parke, NJA), long-tailed weasel (©Dennis Garrison, US Forest Service), blue-spotted salamander (©Mike Bisignano), timber rattlesnake (Kristen Meistrell, NJA), northern parula (NJA archive), and eastern box turtle (Kristen Meistrell, NJA) are all additional species that inhabit forested uplands and wetlands.

Summary

By developing an FSP that incorporates wildlife considerations into FSI practices, landowners have the opportunity to blend multiple objectives while enhancing biodiversity and overall forest health. Natural resource professionals preparing these plans can make specific recommendations based on individual property assessments. Other NRCS fact sheets from this series on forest stewardship planning can be found at: <http://www.njaudubon.org/default.aspx?tabid=2566>

References

- Boyce, M. S., Haney, A. (editors) (1997) *Ecosystem Management: Applications for Sustainable Forest and Wildlife Resources*. Yale University.
- Brittingham, M. C., DeLong, C. A. (1998) Management practices for enhancing wildlife habitat. *Penn State University*. pubs.cas.psu.edu/freepubs/pdfs/uh107.pdf
- Carl, T., Blumenshine, S. (2005) Relationships among vernal pool invertebrate assemblages with habitat morphology and distribution. *Bios*. 76(3). 145-152 p.
- DeGraaf, R. M., et al. (2006) *Technical Guide to Forest Wildlife Habitat Management in New England*. Burlington, VT, University of Vermont Press.
- Gorenzel, W. P., et al. (1995) Characteristics of brushpiles used by birds in Northern California. *The Southwestern Naturalist*. 40(1). 86-93 p.
- Hansen, A. J., et al. (1991) Conserving biodiversity in managed forests. *BioScience*. 41(6). 382-392 p.
- May, H. L. (2002) Managing forests for fish and wildlife. *Fish and Wildlife Habitat Management Leaflet, Number 18*. NRCS, Wildlife Habitat Management Institute. <ftp://ftp-fc.sc.gov.usda.gov/WHMI/WEB/pdf/Forests.pdf>
- New Jersey Division of Fish and Wildlife (2008) *New Jersey Wildlife Action Plan*. Trenton, NJ. http://www.state.nj.us/dep/fgw/ensp/wap/pdf/wap_draft.pdf
- New Jersey Forest Service (2010) *New Jersey Statewide Forest Resource Assessment and Resource Strategies*. Trenton, NJ. <http://www.stateforesters.org/files/NJ-Assess-Strategy-20100810.pdf>
- Ries, L., et al. (2004) Responses to habitat edges: mechanisms, models, and variability explained. *Annual Review of Ecology, Evolution, and Systematics*. 35. 491-522 p.
- Robbins, C. S., et al. (1989) Habitat area requirements of breeding forest birds of the middle Atlantic states. *Wildlife Monographs*. 103. 3-34 p.
- Silveira, J.G. (1998) Avian uses of vernal pools and implications for conservation practice. *Ecology, Conservation, and Management of Vernal Pool Ecosystems*. California Native Plant Society, Sacramento, CA. 92-106 p. <http://vernalpools.org/proceedings/silveira.pdf>
- Walter, S. T., Maguire, C.C. (2005) Cavity-nesting birds, and silvicultural treatments in Western Oregon. *The Journal of Wildlife Management*. 69(4). 1578-1591 p.